

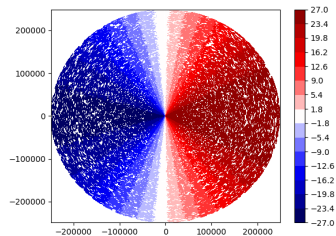
# Dealiasing radial velocities from meteorological Doppler radar

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Joint LACE Data Assimilation WD and ALADIN Data  
Assimilation basic kit WD  
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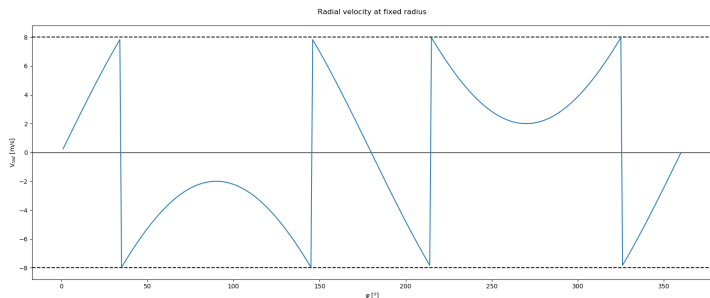
# Agenda

- Describing the problem
- CINDA method
- Austrian method
- Torus method
- Results
- Plan for the future



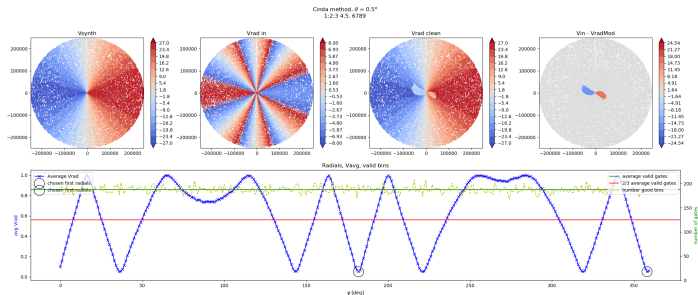
# Description of the problem

- Measurements only on interval  $[-V_{nyquist}, V_{nyquist}]$
- Values outside the interval fold in by  $\pm 2nV_{nyquist}$ ,  $n \in \mathbb{Z}$
- Nyquist velocity is defined by radar settings:  
$$V_{nyquist} = \frac{v_{pulse} \lambda}{4}$$
- $V = V_{obs} + 2nV_{nyquist}$



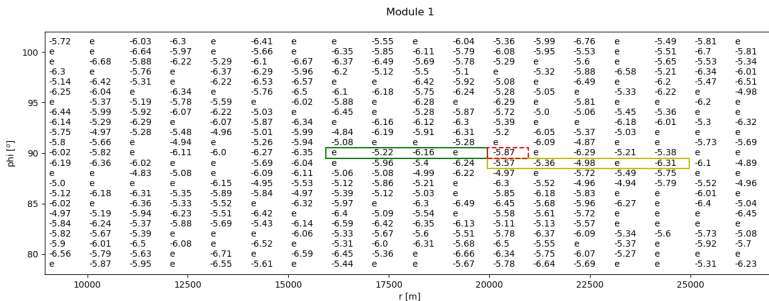
# CINDA method - module 1

- Looking for the first two radials
- Minimum of absolute values
- More than 2/3 good bins
- 180° apart
- Gate to gate dealiasing starting with first radials



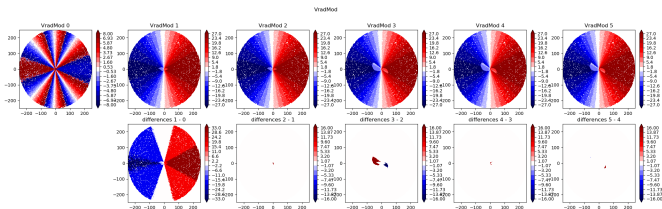
# CINDA method - module 2

- Starting with first radial
- Trying to shift values by  $2nV_{nyquist}$
- Taking the average if necessary
- Threshold value  $\frac{1}{3}V_{nyquist}$



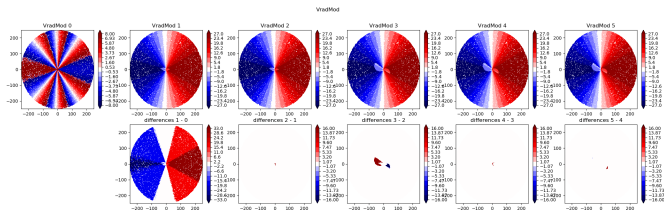
# CINDA method - module 3

- The same sign in one half
- Correcting values to the closest one with the same sign
- Maybe just taking the oposite sign?



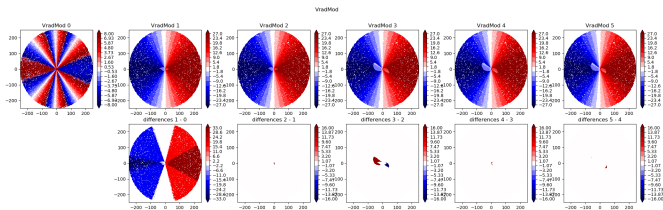
# CINDA method - module 4

- Comparing value to some computed values
- Average for last 20  $r$  and 10  $\varphi$



# CINDA method - module 5

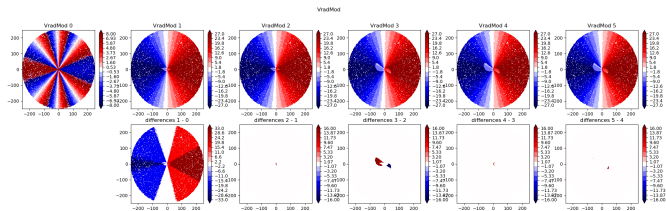
- Fiting function in  $r$
- Linear fit for  $\vartheta \lesssim 6^\circ$
- Quadratic fit for  $\vartheta \gtrsim 6^\circ$





# CINDA method - module 6

- Fiting function in  $\varphi$
- Sine or quadratic function

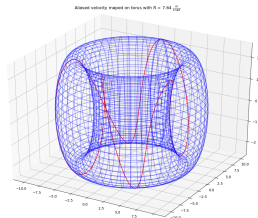
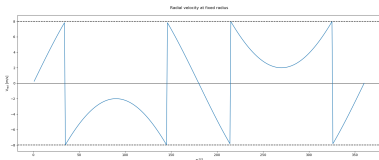


# Austrian method

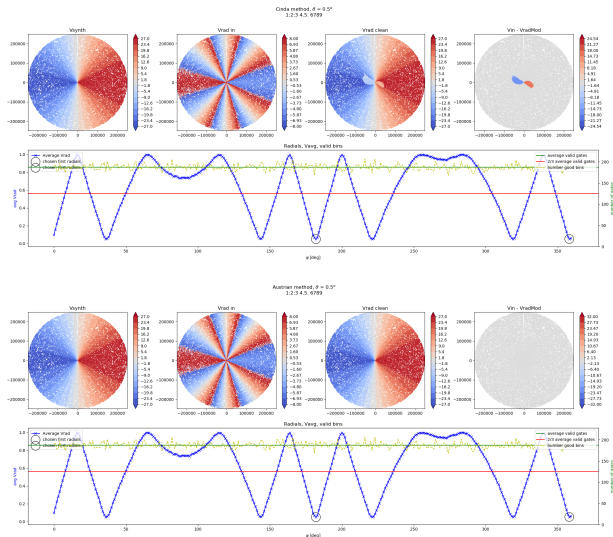
- Dealias first radials (along radial)
- Bin to bin dealiasing from first radials in both directions (CINDA)
- Dealias along radial for whole area
- Dealias from first radials the whole circle in both directions with  $r_{+1}$
- Whole area along radials again
- Removing outliers

# Torus method

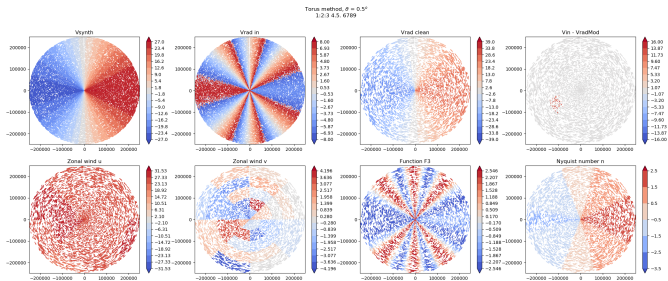
- Mapping values at one radius and one elevation onto a surface of a torus
- $F(\varphi) = \left( A \sin(\varphi), A \cos(\varphi), \frac{V_{nyquist}}{\pi} \cos \left( \pi \frac{V_o}{V_{nyquist}} \right) \right)$
- $A = \left[ R + \frac{V_{nyquist}}{\pi} \sin \left( \pi \frac{V_o}{V_{nyquist}} \right) \right]$
- $\frac{\partial F_3}{\partial \varphi} = -au + bv, V_m = (u \sin \varphi + v \cos \varphi) \cos \vartheta$
- Constants  $u, v$  from minimizing  $D_k - (-ua_k + vb_k)$
- $n$  for each point from minimizing  $V_o + 2nV_{nyquist} - V_m$



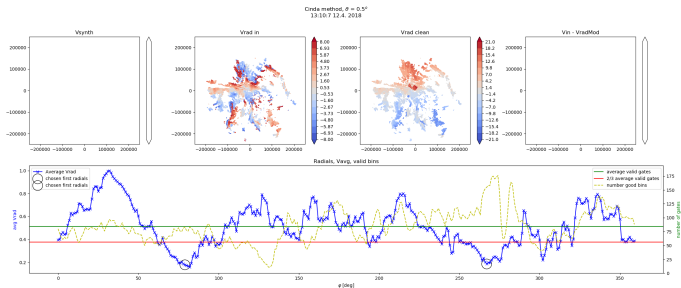
# Results - test data



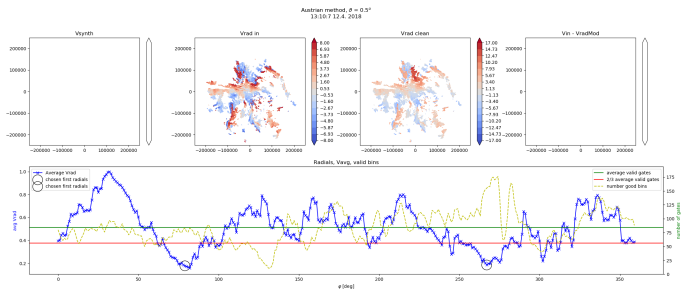
# Results - test data



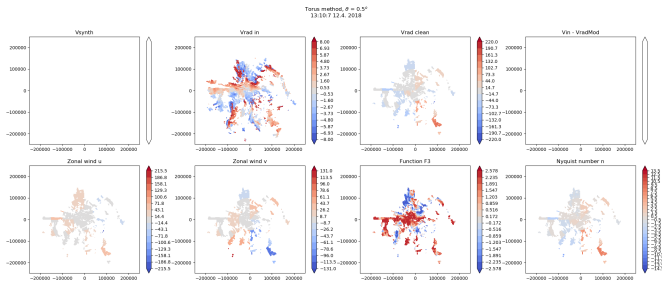
# Results 1



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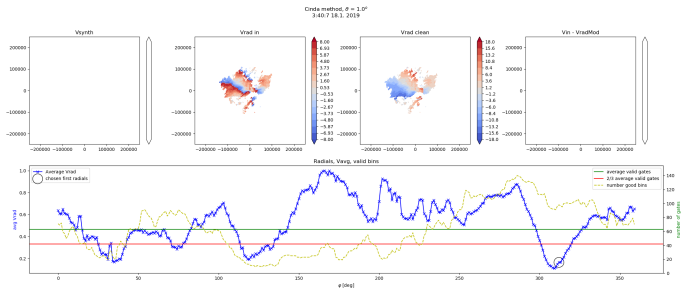


# Results 1

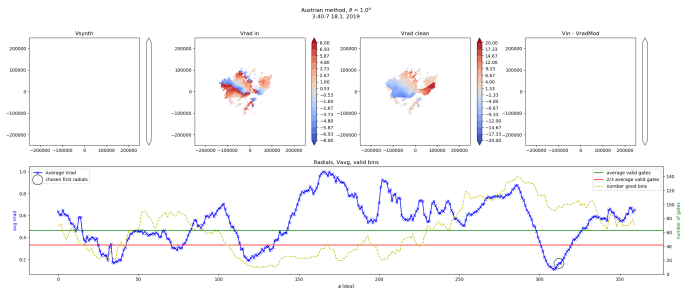




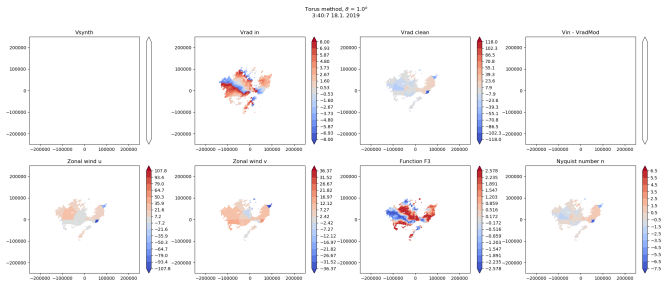
# Results 2



# Results 2



# Results 2



# Plans for the future

- Improving method for locating first radials
- Module 4 improvements for CINDA
- Improving gathering strategy for torus method
- Testing methods in different weather scenarios
- Testing on large set of measurements
- Validating results with radiosonde and ALADIN